

ARH2591

EXTERNAL REFERENCE SPECIFICATION
FOR
SES Virtual Environment GENERATOR

Submitted: _____
Approved: _____

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REVISION DEFINITION SHEET

REV	DATE	DESCRIPTION
Orig	11/03/77	Original ERS
A	05/29/79	R12 changes (new name, MIGDS rev P)
B	02/15/80	R13 changes (Checkpoint File replaces VEF)

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1.0 INTRODUCTION

1.0 INTRODUCTION

1.1 VIRTUAL ENVIRONMENT GENERATOR OVERVIEW

This document defines the external characteristics of the Virtual Environment Generator (VE Generator). It is written in CYBIL and executes as a standalone program under NOS. :

The VE Generator accepts as input, segment files created by the SES Virtual Environment Linker. It loads the segment files onto a "Checkpoint File", creates a page table for the segments, updates exchange packages and segment tables, and produces a listing that describes the segments loaded. The file produced, can be loaded and executed on the C180 Hardware System Simulator, or may be used as input to the HCS C180 Deadstart File generator which produces files acceptable for inclusion on deadstart tapes. :

The VE Generator was developed by the HCS project to satisfy the "system build" functions for the C180 Hardware Checkout System (HCS) and has been modified to satisfy the "system build" functions for A170 and Engineering Services on the S2 testbed. It has been picked up by SES and its usage externalized via SES procs described in a latter section.

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2.0 APPLICABLE DOCUMENTS

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The following is a list of documents that are referred to in this specification or are recommended to aid in understanding this document.

- | | | |
|---|---------|---|
| 1. SES User's Handbook | ARH1833 | : |
| 2. ERS for SES Virtual Environment Linker | ARH1680 | : |
| 3. ERS for CYBER 180 Simulator | ARH1729 | : |
| 4. C180 MIGDS | ARH1700 | : |
| 5. C180 Object Code Utilities | ARH2922 | : |

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3.0 DESCRIPTION

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Many of the parameters handled by the VE Generator represent values that will be used to set tables and registers required by C180 hardware. Descriptions of these fields can be found in the C180 MIGDS. They include page tables, P, A3, segment tables, exchange packages, page size, page table address, page table size, load address, ASID, VCUM, TOS pointers, STA fields, segment number, VXRW, R1R2 and KI.

The VE Generator's function is to construct a "Checkpoint File" (CPF) from the file sets which were output by the Virtual Environment Linker. This file can then be read by the C180 Simulator, the HCS Deadstart tape generator, and various utilities used by A170 for offline diagnostics. In creating the Checkpoint File, the following functions are performed:

- A page table is built. Entries are made in the page table for all pages loaded during the generation process and for segments defined via the "SEGDEF" command.
- The exchange packages for the monitor and job mode processes are located. The initial "P" and "A3" values for the primary entry points are stored into the exchange packages.
- The segment tables for the monitor and job mode processes are located. Entries are made in the segment tables for each segment encountered during the generation process. Provisions are made for the user to change segment attributes or to define additional segments.

The processing is divided into 5 phases. Each of the phases is described below.

3.1 PARAMETER DEFINITION PHASE

This phase allows the user to supply values for parameters which are used during the remaining phases to control the generation process and page table generation process. Values for the following parameters may be supplied during this phase:

3.0 DESCRIPTION3.1 PARAMETER DEFINITION PHASE

- page size
- page table size
- page table address
- real memory address to begin the load
- load offset (used only by A170)
- locations of monitor and job mode exchange packages
- NOS/VE option (to specify that the load is for the NOS/VE OS)
- size of NOS/VE monitor heap
- size of NOS/VE job heap
- size of NOS/VE program directory

3.2 LOADING PHASE

After the parameter definition phase is completed, the loading phase is started. During this phase, one or more sets of segment files (one set from each prior call to the VE Linker) is loaded into the "Virtual Environment File". For each set of segment files, the user specifies whether the segments belong in the monitor address space or the job's address space. The first segment is loaded at the address specified by the <load address> parameter. Subsequent segments are loaded at the page boundary following the end of the previous segment. As each segment is loaded, the attributes of the segment are recorded as specified in the LINKER output and the real memory addresses assigned to the segment in tables internal to the Generator. This information is used during subsequent phases to build the page and segment tables.

3.3 SEGMENT DEFINITION AND MODIFICATION PHASE

After all segments have been loaded, the user can alter segment attributes as defined in the segment table entries for the segments of any of the segments loaded during the previous phase. New segments may also be defined here although no data can be stored in the segments.

3.4 PAGE AND SEGMENT TABLE GENERATION

During this phase, the following steps are performed:

1. ASIDs are assigned to each segment using an ASID assignment algorithm that scatters the page table entries throughout the

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3.0 DESCRIPTION3.4 PAGE AND SEGMENT TABLE GENERATION

page table. The user can override this algorithm by specifying ASIDs in the SEGMENT MODIFICATION phase.

2. Entries are made in the page table for all pages loaded during the LOAD phase or defined in the SEGMENT DEFINITION phase. The VCUM bits in the page table entry are set to 1X01.
3. The exchange packages for monitor and job mode are located. The following fields in the exchange packages are modified:
 - a. If a "primary entry point" was specified, P and A3 are set to point to the primary entry point.
 - b. For each TOS pointer in the job and monitor exchange package with a non-zero ring number, the ring stack ring (i.e., the ring N TOS pointer ring number is set to "N", etc.).
 - c. The load address of the segment containing the exchange package is added to the STA field.
4. The segment tables for monitor and job mode are located. Entries are made in the monitor and job segment tables for all segments defined as belonging to monitor or job mode respectively.

3.5 DISPLAY PHASE

The final phase provides the capability for generating hex :
dumps of the load file. :

3.6 COPY TO CHECKPOINT FILE PHASE

Using library procedures, the "Virtual Environment" File is :
copied to a Checkpoint File (CPF). :

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 4.0 COMMAND DEFINITIONS

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(Note that the command syntax for the VE Generator is not compatible with the proposed C180 command syntax. A summary of commands and the general syntax rules appears in Appendix A. We apologize for the way TXTFORM capitalizes parameter names that appear in section headings.)

4.1 CV PAGESIZE N

This command is used to specify the page size to be used in loading the segments.

n: page size in bytes. The value supplied must be a valid
 CYBER 80 pagesize; if the value is not a power of 2, a
 diagnostic is issued. !
 (default = 1024) !

4.2 CV PTA N

This command is used to specify the beginning real memory address of the page table; the value is not checked for validity.

n: byte address of the beginning of the page table
 (default = 0)

4.3 CV PTL N

This command is used to specify the length of the page table. !

n: page table length in bytes; if the value is not a power
 of 2, a diagnostic is issued. !
 (default = 4096) !

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4.0 COMMAND DEFINITIONS

4.4 CV LOADADR N

4.4 CV LOADADR N

This command is used to specify the initial real memory load address to use to load segments into memory.

n: byte address
(default = 4096)

4.5 CV LOADOFFSET N

This command provides an "offset loading" capability similar to that provided by the SES Virtual Environment Linker. This command is used when the code and page tables will be executed at a different "real memory address" than that at which they are loaded. For example, the A170 Error Interface executes at RMA = 248K (for a 256K memory configuration). If offset loading is not used, the load file generated, will begin with 248K bytes of zeroes. If the "loadoffset" is set to 248K, the first byte on the "Virtual Environment File" will correspond to the byte that should be placed at RMA 248K for execution. NOTE: If offset loading is used, the load file is not acceptable to the C180 Simulator.

n: load offset in bytes
(default = 0)

4.6 CV JPS MD SN BN

This command is used to specify the location of the JOB mode exchange package. If this command is omitted, initialization of the job mode exchange package is omitted.

md: specifies whether the exchange package is located in a segment that is loaded as part of monitor or job mode. Valid values for this parameter are:

MTR - monitor mode
JOB - job mode

sn: specifies the segment number that contains the exchange package.

bn: specifies the byte offset to the beginning of the

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4.0 COMMAND DEFINITIONS4.6 CV JPS MD SN BN

exchange package from the beginning of the segment.

4.7 CV MPS MD SN BN

This command is used to specify the location of the monitor exchange package. See the command "CV JPS" for additional detail.

4.8 CV LIBSEG SN

This command defines the segment number (SN) to be used by the GENERATOR for the user library segment.

4.9 CV PPLIBSEG SN

This command defines the segment number (SN) to be used by the GENERATOR for the pp library segment.

4.10 CV SEG EXTEND MD SN BC

This command extends the size of the specified segment (SN) by (BC) bytes.

md: specifies whether the specified segment is loaded as part of monitor or job mode. Valid values for this parameter are:

MTR - monitor mode

JOB - job mode

4.11 CV DIRECTORY LENGTH LENGTH

This command specifies the length of the directory of the user library.

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4.0 COMMAND DEFINITIONS

4.12 CV HCVSLOAD

4.12 CV HCVSLOAD

This command must be specified in order for the values indicated by the XXX_LOC commands to be stored.

4.13 CV XXX_LOC MD SN BN

The following directives of the above format define the locations of values that are to be stored (at the end of processing) by the GENERATOR. Note that the command CV HCSLOAD must be specified in order for the values to be stored. Parameters to the directives are as follows:

md: specifies whether the value is to be stored in a segment that is loaded as part of monitor or job mode. Valid values for this parameter are:

MTR - monitor mode
JOB - job mode

sn: specifies the segment number in which to store the value.

bn: specifies the byte offset in the specified segment to store the value.

The commands are as follows:

CV HEAP_START_LOC

Directive to store the lengths of segments 1 thru 10.

CV PP_ADR_ARRAY_LOC

Causes the array of word offsets from the beginning of the segment to be converted to real memory word addresses and stored. The end of the array is followed by a word of zeros.

CV SEGCOUNT_LOC

Directive to store number of segments generated during the load.

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4.0 COMMAND DEFINITIONS4.13 CV XXX_LOC MD SN BN

CV LIB_SEG_LOC

Directive to store user library segment.

CV PP_LIB_SEG_LOC

Directive to store pp library segment.

CV PAGE_SIZE_LOC

Directive to store page size.

CV PAGES_LOADED_LOC

Directive to store number of pages loaded.

CV OST_LOC

Directive to store a pointer to the outboard symbol
table specified by the LOADOST command.4.14 LOADMTR_SEED

This command directs the VE Generator to load the segment files produced by the SES Virtual Environment Linker into memory beginning at the next page boundary. The segments loaded are identified as belonging to the monitor mode address space. Multiple LOADMTR commands as permitted.

seed: 4 character "seed" named used by the LINKER.

4.15 LOADLIB_SEED_PN_RE

This command directs the GENERATOR to add the specified user task to the user task to the user library.

seed: 4 character "seed" named used by the LINKER.

pn: Name to be given to the user task.

re: IF "NR", program is not reentrant.

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4.0 COMMAND DEFINITIONS

4.16 LOADPPLIB FILENAME

4.16 LOADPPLIB FILENAME

This command directs the GENERATOR to load the pp library segment (previously created by the utility M7PPG)

4.17 LOADOST MD SEED SN

This command directs the GENERATOR to store the outboard symbol table specified by the "seed" name at the end of the specified segment.

md: specifies whether the outboard symbol table is to be located at the end of a segment that is loaded as part of monitor or job mode. Valid values for this parameter are:

MTR - monitor mode

JOB - job mode

seed: 4 character "seed" name to be concatenated with "OST" to form the name of the file from which to read the outboard symbol table.

sn: specifies the segment number at the end of which to store the outboard symbol table.

4.18 LOADJOB SEED

This command directs the VE Generator to load segment files produced by the SES Virtual Environment Linker into memory beginning at the next page boundary. The segments loaded are identified as belonging to the job mode address space. Multiple LOADJOB commands are permitted.

seed: 4 character "seed" name used by the LINKER

4.19 SEGDEF MD SN ASID ADR LEN VXRW R1R2 KL SWATTR

This command is used to define a new segment in addition to the segments defined during the LOAD phase. Page and segment table entries will be made for the segment. (This command can be

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4.0 COMMAND DEFINITIONS4.19 SEGDEF MD SN ASID ADR LEN VXRW R1R2 KL SWATTR

used to define the segment that contains the page table if the page table is not a part of any of the segments loaded during the LOAD phase. This command can also be used by A170 to define the segment that contains NOS.)

md - specifies whether the segment belongs to the monitor and/or job mode address space. Valid values for this parameter are:

MTR - monitor mode

JOB - job mode

BOTH - both monitor and job mode

sn - segment number. Used to make the segment table entry.

asid - specifies the ASID to be assigned to the segment. If a value of zero is specified, an ASID will be generated.

adr - real memory byte address of the beginning of the segment.

len - length of the segment in bytes.

VXRW - an 8 bit value that is placed in the VXRW fields of the segment descriptor for the segment.

R1R2 - an 8 bit value that is placed in the R1 and R2 fields of the segment descriptor for the segment.

kl - an 8 bit value that is placed in the key-lock fields of the segment descriptor.

swattr - a 24 bit value that is placed in the rightmost 24 bits of the segment descriptor. This field is for software use only.

4.20 SEGCHAN MD SN NEWMD ASID VXRW R1R2 DL SWATTR

This command is used to change the segment attributes of segments defined during the LOAD phase. The segment is identified by the <md> and <sn> parameters. See the SEGDEF command for the definition of the parameters.

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4.0 COMMAND DEFINITIONS4.21 SEGSHARE MD SN NEWMD NEWSN4.21 SEGSHARE MD SN NEWMD NEWSN

This command is used to specify that a segment defined during the LOAD phase or through the SEGDEF command should appear in multiple segment table entries. The segment to be shared is identified with the <md> and <sn> parameters. An additional segment table entry will also be made for the segment in the address space identified by <newmd>. The new entry is assigned a segment number of <newsn>.

4.22 DM DISPLAYMD

This command is used to generate hex dumps of the load file. The field <displaymd> specified the memory to be dumped. Valid values for <display md> are:

ALL : all memory loaded during the LOAD phase is dumped.

PAGE_TABLE : page table is dumped.

MPS : monitor exchange package.

JPS : job exchange package

adr len : "len" bytes of memory are dumped beginning at byte address "adr".

4.23 DM DIRECTORY

This command directs the GENERATOR to print the directory of the user library generated.

4.24 CM RMA VAL,VAL...

This command caused memory locations starting at RMA to be replaced with the specified values.

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4.0 COMMAND DEFINITIONS4.25 END
-----4.25 END

This command terminates processing and must be the last command in the command file.

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The VE Generator can be executed alone, or along with the VE Linker as described in the following sections. These sections are also contained in the SES User's Handbook. If there is a discrepancy, the description in the SES User's Handbook is probably most current.

GENCPF - GENERATE A CHECKPOINT FILE (CPF)

GENCPF executes the SES VE Linker and the SES VE Generator and produces a Checkpoint File (CPF) which can be loaded and executed on the CYBER 180 hardware system simulator. The user must provide a file containing 180 object text, and can optionally provide a Linker Parameter File (LPF), a set of Monitor Segment files, and/or a VE Generator DIRECTIVE file. The "MF" file will contain the map produced by the VE Linker and additional information produced by the VE Generator.

Note: most of the following parameters will not be used by the "general public" (examples show general usage).

Parameters to GENCPF are:

ofl (Filename(s), optional)

Object_File_List - list of up to 10 names of files containing 180 object text (ver 1.1). This parameter does not have a default.

lfl (Filename(s), optional)

Library_File_List - list of up to 10 names of Library files containing 180 object text. This parameter does not have a default.

pep (String(31), optional)

Primary_Entry_Point - This parameter specifies the entry point at which to start execution. The default is to start execution at the first Transfer symbol encountered.

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ns (String(4), optional)

Name_Seed - This parameter specifies the "name seed" for the VE Linker Segment files. The default for this parameter is "SEGM". The value of this parameter OVERRIDES any Linker Parameter File specification of this field.

mf (Filename, optional)

Map_File - This parameter specifies the name of the map file. The default for this parameter is "LINKMAP".

mo (Char 1, optional)

Linker Map options - This parameter specifies the amount of information output on the Linker Map. The value of this parameter OVERRIDES any Linker Parameter File specification of this field. Values for this field are:

- N - no map information; diagnostics are output.
- S - section allocations for every section of every input object module
- E - Section allocations plus entry point names and address assignments
- M - Section allocations, entry points plus output segment and common block allocations (full Linker map).

rewind (Keyword, optional)

Rewind_map_file - This parameter specified whether to rewind the Map file before it is written. Default is to rewind it. The value of this parameter OVERRIDES any Linker Parameter File specification of this field. Keyword value meanings are:

- REWIND - rewind Map file
- NOREW - don't rewind Map file

lpf (Filename, optional)

Linker_Parameter_File - This parameter specifies a file that contains Linker parameters that affect the Link. If no lpf is specified, default values indicated in the LPF description apply.

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cybilib (Keyword, optional)

This parameter, when specified, will cause CYBILIB to be used to satisfy externals during the linking process. The procedure will ACQUIRE the file from SES and add it to the Library_File_List. The default is not to use CYBILIB as part of the Link.

cpf (Filename, optional)

Checkpoint_File - This parameter specifies the name of the file containing the output from the VE Generator. The default is "CPFILE". The value of this parameter OVERRIDES any Linker Parameter File specification of this field.

lpf (Filename, optional)

Linker_Parameter_File - This parameter specifies a file built by the BLDLPF procedure, and contains Linker parameters that affect the Link. The default is to use the standard values as specified in the "SES VE Linker ERS" (ARH2816).

dir or ldrdir or d (Filename, optional)

Directives - This parameter specifies the name of a file containing directives to the VE Generator. The default will be a file containing default directives.

mtrns or mns (String(4), optional)

Monitor Name_Seed - This parameter specifies the "name seed" of the VE Linker Segment files that contain the Monitor code. This parameter is provided to allow the user to have his own Monitor program. The default for this parameter is "MTRX". The procedure will check the local files, the local PF catalog, and then the SES catalog to get the files.

Examples:

The following example illustrates how a user would compile a test program written in CYBIL, generate a Checkpoint File, and run it on the Simulator.

```
ses.cybil ci l=testprg l=testlst b=testlgo
ses.gencpf ofl=testlgo cpf=testcpf cybilib
ses.sim180 restart=testcpf
```

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```
? run
? bye
```

The last two lines were Simulator commands. |

The next example illustrates how to generate a Checkpoint File |
from several input files of 180 object text.

```
ses.gencpf ofl=(mylgo1,mylgo2) cpf=mycpf cybilib |
```

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VEGEN - EXECUTE THE SES CHECKPOINT GENERATOR

VEGEN executes the SES VE Generator which produces a Checkpoint File (CPF) that can be loaded and executed on the CYBER 180 hardware system simulator. The input to the VE Generator is the set of Segment files containing the users program and a default set of segment files containing a simple monitor program. The monitor program contains code that sets up the exchange packages, stack areas, and also provides a primitive Monitor and Trap Handler routines and a Termination routine. For more information on the VE Generator, refer to the "SES Virtual Environment ERS" (ARH2591).

Note: this proc is generally used only in special cases, where GENCPF is inadequate.

Parameters to VEGEN are:

dir or ldrdir or d (Filename, optional)

Directives - This parameter specifies the name of a file containing directives to the VE Generator. The default will be a file containing default directives.

ns (String(4), optional)

Name_Seed - This parameter specifies the "name seed" of the VE Linker Segment files. The default for this parameter is "SEGM".

mtrns or mns (String(4), optional)

Monitor Name_Seed - This parameter specifies the "name seed" of the VE Linker Segment files that contain the Monitor code. This parameter is provided to allow the user to have his own Monitor program. The default for this parameter is "MTRX". The procedure will check the local files, the local PF catalog, and then the SES catalog to get the files.

cpf (Filename, optional)

Checkpoint_File - This parameter specifies the name of the file containing the output from the VE Generator. The default is "CPFILE".

mf (Filename, optional)

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Map_File - This parameter specifies the name of the file on which to write the map information. The default is "LINKMAP".

Example:

In the following example, the Generator is passed a directive file, a set of segment files containing the test program, a set of monitor files, and produces a Checkpoint File and Map file. :

```
ses.vegen dir=mydir ns='test' mtrns='mtrx' cpf=mycpf mf=mymap :
```

EXAMPLES OF COMMAND FILES:

1. The following example shows the command file required to load a single test program.

```
CV PTA 0
CV PTL 4096
CV PAGESIZE 4096
CV JPS MTR 4 2040(16)
CV MPS MTR 4 1EAD(16)
CV LOADADR 4096
LOADMTR SEED
SEGCHAN MTR 4 MTR 0 10101010(2)
DM PAGE_TABLE
DM ALL
END
```

2. The following example shows the command file for loading the A170 Error Interface for a 256K configuration.

```
CV PTA 2093056
CV PTL 4096
CV PAGESIZE 4096
CV JPS MTR 1 432
CV MPS MTR 1 0
CV LOADADR 2088960
CV LOADOFFSET 2088960
LOADMTR SEED
SEGDEF BOTH 0 NOS OFFFF(16) 0 2088960 10101010(2) 11(16) 0 0
SEGCHAN MTR 1 MTR 8000(16)
DM PAGE_TABLE
DM ALL
END
```

A1.0 COMMAND SUMMARY

A1.0 COMMAND SUMMARY

The VE Generator accepts input either directly from the terminal or from a mass storage command file. The command syntax is as follows:

- Commands may be either upper or lower case ASCII.
- Integers have a default base of 10. Hex or binary data is entered by appending the base to the integer specification.

(Example: 1024, 400(16), 10010110(2))

- Parameters may be separated with blanks or a comma. Missing parameters are denoted by 2 successive commas. A missing parameter is assumed to have a value of zero.

A1.1 PHASE 1 COMMANDS

CV PAGESIZE <pagesize>

CV PTA <page table address>

CV PTL <page table length>

CV LOADADR <initial load address>

CV LOADOFFSET <initial load offset>

CV MPS <adr space md> <segment number> <byte offset>

CV JPS <adr spacemd> <segment number> <byte offset>

<page size> ::= <byte length>

<page table address> ::= <byte address>

<page table length> ::= <byte length>

<adr space md> ::= MTR|JOB|BOTH

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A1.0 COMMAND SUMMARYA1.1 PHASE 1 COMMANDS

<segment number> ::= <integer>

<byte offset> ::= <integer>

<byte address> ::= <integer>

<byte length> ::= <integer>

A1.2 PHASE 2 COMMANDS

LOADMTR <linker seed name>

LOADJOB <linker seed name>

<linker seed name> ::= <4 character seedname>

A1.3 PHASE 3 COMMANDS

SEGDEF <adr space md> <segment number> <asid> <byte address>
<segment length> <VXRW> <R1R2> <keylock> <swattr>

SEGCHAN <adr space md> <segment number> <new adr space md> <asid>
<VXRW> <R1R2> <keylock> <swattr>

SEGSHARE <adr space md> <segment number> <new adr space md> <new
segment number>

<asid> ::= <integer>

<segment length> ::= <byte length>

<VXRW> ::= <integer> "8 bit VXRW fields in segment
descriptor"

<R1R2> ::= <integer> "8 bit R1 and R2 field in segment
descriptor"

<keylock> ::= <integer> "8 bit keylock field in segment
descriptor"

<swattr> ::= <integer> "Rightmost 24 bits of segment descriptor
word. Used by software only."

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A1.0 COMMAND SUMMARY
A1.4 PHASE 4 COMMANDS

A1.4 PHASE 4 COMMANDS

None

A1.5 PHASE 5 COMMANDS

DM ALL

DM PAGE_TABLE

DM MPS

DM JPS

DM <byte address> <byte length>

END

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